CLAIMS:

1. A method for producing polymer particles for use as a vaccine delivery system in which a water insoluble protein antigen is incorporated with particles comprising a polymer matrix, wherein the method comprises:-

(a) mixing an aqueous phase (W) with an organic phase(O) that is immiscible with W to produce a W/O emulsion, in which the water insoluble protein is solubilised in the W phase using a solubilising agent, and the O phase comprises the matrix polymer in an organic solvent;

(b) forming droplets of said W/O emulsion by dispersing the emulsion in a fluid medium, and removing said solvent from the O phase of the W/O emulsion droplets to thereby form polymer particles incorporating the water insoluble protein antigen; and

wherein in step (a) a stabilising agent is included in the W/O emulsion to promote the incorporation of the water insoluble protein with the polymer particles during step (b) by stabilising the W/O emulsion in the presence of said solubilising agent.

2. The method of claim 1, wherein more than one stabilising agent is included in the W/O emulsion.

3. The method of claim 1 or 2, wherein the or each stabilising agent is selected from polymers, polar lipids, and hydrophobic surfactants.

4. The method of any preceding claim, wherein a stabilising agent is used that is a polymer selected from poly(vinyl pyrrolidone), poly(vinyl alcohol), polysaccharides, polyethyleneoxide and water soluble proteins.

5. The method of any one of claims 1 to 3, wherein a stabilising agent is used that is a polar lipid selected from cholesterol, phosphatidylcholine, phosphatidylethanolamine, phosphatidylglycerol, glycolipids and phosphatidic acid.

6. The method of any one of claims 1 to 3, wherein a stabilising agent is used that is a non-ionic, hydrophobic surfactant selected from a sorbitan fatty acid ester, hydrophobic polyoxyethylene alkyl ether, sucrose ester, alkyl-glucopyranoside, polyglycerol polyricinoleate and block-copolymers of ethylene oxide with propyleneoxide and/or lactic acid.

7. The method of any one of claims 1 to 3, wherein a stabilising agent is used that is an anionic, hydrophobic surfactant selected from an alkylsulphate salt, dialkylsulphosuccinate salt, alkylbenzene sulphonate salt and a fatty acid salt.

8. The method of any one of claims 1 to 3, wherein a stabilising agent is used that is a cationic, hydrophobic surfactant selected from an alkyltrimethylammonium salt and a dialkyldimethylammonium salt.

9. The method of claim 2, wherein a sorbitan fatty acid ester is used as a stabilising agent.

10. The method of claim 2, wherein poly(vinyl pyrrolidone) and sodium 1,4-bis (2-ethylhexyl) sulphosuccinate are used as stabilising agents.

11. The method of any preceding claim, wherein more than one solubilising agent is used.

12. The method of any preceding claim, wherein a hydrophilic surfactant is used as a solubilising agent.

13. The method of claim 12, wherein the hydrophilic surfactant is a non-ionic surfactant selected from alkyl-glucopyranosides, alkyl-thioglucopyranosides, alkyl-maltosides, alkoyl-methyl glucamides, polyoxyethylene alcohols, polyoxyethylene alkyl phenols, emulphogens, polyoxyethylene sorbitol esters, polyoxyethylene fatty acid esters, hydrophilic polyoxyethylene alkyl ethers and digitonin.

14. The method of claim 12, wherein the hydrophilic surfactant is an anionic surfactant selected from cholates, alkylsulphonates, deoxycholates, alkylsulphates, oligooxyethylene dodecyl ether sulphates and sodium dodecylsarcosinate.

15. The method of claim 12, wherein the hydrophilic surfactant is a cationic surfactant selected from alkylpyridinium salts and alkyltrimethylammonium salts.

16. The method of claim 12, wherein the hydrophilic surfactant is a zwitterionic surfactant selected from CHAPS, CHAPSO, BIGCHAP, deoxy BIGCHAP, lyso phosphatidylcholine, alkylbetaines and sulphobetaines.

17. The method of any one of claims 1 to 11, wherein a chaotropic agent is used as a solubilising agent.

18. The method of claim 17, wherein the chaotropic agent is selected from a perchlorate, thiocyanate, guanidine, chlorate, iodide, bromide, nitrate and urea.

19. The method of any preceding claim, wherein the method is a Double Emulsion (W/O/X) Solvent Evaporation Technique for producing polymer particles for use as a vaccine delivery system, in which in step (b) the stabilised W/O emulsion is dispersed in a liquid phase (X) which is immiscible with the O phase to produce a W/O/X double emulsion comprising W/O droplets from which the solvent is evaporated, thereby producing said polymer particles incorporating the water insoluble protein antigen.

20. The method of any one of claims 1 to 18, wherein the method is a Double Emulsion (W/O/X) Solvent Extraction Technique for producing polymer particles for use as a vaccine delivery system, in which in step (b) the stabilised W/O emulsion is dispersed in a liquid phase (X) which is immiscible with the O phase to produce a W/O/X double emulsion comprising W/O droplets, wherein the X phase extracts said solvent from the O

phase of the droplets, thereby producing said polymer particles incorporating the water insoluble protein antigen.

21. The technique of claim 19 or 20, wherein a stabilising agent is included in the X phase.

22. The technique of claim 21, wherein a stabilising agent as defined in any one of claims 3 to 8 is used in the X phase.

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23. The method of any one of claims 1 to 18, wherein the method is a spray drying technique for producing polymer particles for use as a vaccine delivery system, in which in step (b) the stabilised W/O emulsion is dispersed in a gaseous medium to form a spray of W/O emulsion droplets from which said solvent evaporates, thereby producing said polymer particles incorporating the water insoluble protein antigen.

24. The method of any one of claims 1 to 18, wherein in step (b) a fluid gas technique is used to form the polymer particles.

25. The method of claim 24, wherein the fluid gas technique is selected from GAS, SEDS, PCA, SAS and ASES.

26. The method of any preceding claim, wherein the protein antigen is a *Helicobacter* protein or fragment thereof.

27. The method of claim 26, wherein the protein antigen is a *Helicobacter pylori* protein or fragment thereof.

28. The method of claim 26 or 27, wherein said *Helicobacter* protein is a protein expressed on the surface of *Helicobacter*.

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29. The method of claim 28, wherein the *Helicobacter* protein is a lipidated form of HpaA.

30. The method of claim 29, wherein the protein is a fully lipidated form of HpaA.

31. The method of claim 28, wherein the protein part of the lipidated HpaA protein has an amino acid sequence that is identical to, or substantially similar to, positions 28 to 260 of SEQ ID NO. 2 or 4.

32. The method of any preceding claim, wherein the matrix polymer is a homo- or co-polymer selected from one or more of polyesters, polyanhydrides, polyorthoesters, polycarbonates, polyamides, poly(amino acids), polyacetals, polycyanoacrylates, polyacrylates, biodegradable polyurethanes, non-erodable polyurethanes, polymers of ethylene-vinyl acetate, acyl substituted cellulose acetates, polysaccharides, polystyrenes, polyvinyl chloride, polyvinyl fluoride, poly(vinyl imidazole), chlorosulphonated polyolefins, polyethylene oxide, polyethers and polyoxalates.

33. The method of claim 32, wherein the polymer is a polyester homopolymer selected from polylactic acid, polyglycolic acid, polyhydroxybutyrate, poly(alpha hydroxyacids) and polycaprolactone.

34. The method of claim 32, wherein the polymer is a polyester co-polymer selected from poly(lactide-co-glycolide), poly(lactic-co-glycolic acid), poly(hydroxybutyrate-hydroxyvalerate) and poly(lactide-co-caprolactone).

35. The method of claim 34, wherein the matrix polymer is poly(D,L-lactide-co-glycolide).

36. The method of any preceding claim, wherein in step (a) the W phase is mixed with the O phase in a ratio by volume of 1:100 to 1:1.

37. A polymer particle vaccine delivery system obtainable by the method of any preceding claim.

38. A polymer particle vaccine delivery system in which a water insoluble protein antigen is incorporated with particles comprising a polymer matrix.

39. The vaccine delivery system of claim 38, wherein the protein antigen is a *Helicobacter* protein or fragment thereof.

40. The vaccine delivery system of claim 39, wherein the protein antigen is a *Helicobacter pylori* protein or fragment thereof.

41. The vaccine delivery system of claim 39 or 40, wherein said *Helicobacter* protein is a protein expressed on the surface of *Helicobacter*.

42. The vaccine delivery system of claim 41, wherein the *Helicobacter* protein is a lipidated form of HpaA.

43. The vaccine delivery system of claim 42, wherein the protein is a fully lipidated form of HpaA.

44. The vaccine delivery system of claim 42, wherein the protein part of the lipidated HpaA protein has an amino acid sequence that is identical to, or substantially similar to, positions 28 to 260 of SEQ ID NO. 2 or 4.

45. The vaccine delivery system of any one of claims 38 to 44, wherein the matrix polymer is a homo- or co-polymer selected from one or more of polyesters, polyanhydrides, polyorthoesters, polycarbonates, polyamides, poly(amino acids), polyacetals, polycyanoacrylates, polyacrylates, biodegradable polyurethanes, non-erodable polyurethanes, polymers of ethylene-vinyl acetate, acyl substituted cellulose acetates, polysaccharides, polystyrenes, polyvinyl chloride, polyvinyl fluoride, poly(vinyl imidazole), chlorosulphonated polyolefins, polyethylene oxide, polyethers and polyoxalates.

46. The vaccine delivery system of claim 45, wherein the polymer is a polyester homopolymer selected from polylactic acid, polyglycolic acid, polyhydroxybutyrate, poly(alpha hydroxyacids) and polycaprolactone.

47. The vaccine delivery system of claim 45, wherein the matrix polymer is a polyester co-polymer selected from poly(lactide-co-glycolide), poly(lactic-co-glycolic acid), poly(hydroxybutyrate-hydroxyvalerate) and poly(lactide-co-caprolactone).

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48. The vaccine delivery system of claim 47, wherein the matrix polymer is poly(D,L-lactide-co-glycolide).

49. The vaccine delivery system of any one of claims 37 to 48, wherein the polymer particles have an average diameter of 0.05-20μm according to the volume size distribution.

50. A vaccine composition comprising the vaccine delivery system of any one of claims 37 to 49.

51. Use of the delivery system of any one of claims 37 to 49 in the manufacture of a vaccine composition, for the treatment of *Helicobacter* infection in a mammalian host.

52. Use of the delivery system of any one of claims 37 to 49 in the manufacture of a vaccine composition, for preventing or reducing the risk of *Helicobacter* infection in a mammalian host.

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